

STATE OF NEW HAMPSHIRE

Inter-Department Communication

DATE: 7/15/09

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SUBJECT DES's Changing Approach to Impervious Surfaces and Opportunities for Improving Source Protection

TO Surface Water Working Group

I. INTRODUCTION

Purpose:

DES has adopted amended rules that define and limit impervious areas for land development projects located within shoreland areas under the jurisdiction of the Comprehensive Shoreland Protection Act (CSPA). DES has also adopted rules that encourage site designers to break up impervious areas and disconnect them from one another, with a view to reducing their impact, for projects that fall under the Alteration of Terrain (AOT) program. The purpose of this memo is to describe how impervious and partially pervious areas, such as lawns, are addressed in both sets of rules and to identify policy or program opportunities that will improve the protection of surface waters.

Why is impervious area an issue?

Replacing the natural landscape with parking lots, roads, rooftops or other impervious areas increases the volume of runoff that may contain high levels of pollutants such as nutrients, metals, bacteria or pathogens. Excessive nutrients can upset the natural nutrient balance within a river or lake ecosystem and result in algal blooms causing taste and odor problems and the formation of harmful drinking water treatment by-products, such as trihalomethanes. The percentage of impervious area in a watershed has been widely recognized as a key indicator of the effects of non-point runoff and of future water and ecosystem quality.¹

What is an impervious surface?

The AOT rules define *impervious cover* as “a structure or a land surface with a low capacity for infiltration, including but not limited to pavement, roofs, roadways, or compacted soils that has a runoff curve number of 98 or greater.” This definition includes paved surfaces and compacted soils but excludes most other modified surfaces. The Comprehensive Shoreland Protection Act (CSPA), as amended in 2008, defines *impervious surfaces* as, “any modified surface that cannot effectively absorb or infiltrate water. Examples of impervious surfaces include, but are not limited to, roofs, decks, patios, and paved, gravel, or crushed stone driveways, parking areas, and walkways unless designed to effectively absorb or infiltrate

¹ Arnold, C. and J. Gibbons, Impervious Surface Coverage: The Emergence of a Key Environmental Indicator. Journal of the American Planning Association 62(2):243-258. (1996)

water.” See Table 1 (below) listing examples of surfaces that would be considered impervious under each definition.

Table 1
Comparison of Surfaces Considered Impervious
Under DES AOT and Shoreland Protection Rules

	Impervious Cover Under AOT ²	Impervious Surface under CSPA ³
Crushed stone driveways		X
Decks	X	X
Gravel roads		X
Paved driveways	X	X
Paved parking lots	X	X
Paved roads	X	X
Roofs	X	X
Walkways	X	X

What are the impacts associated with impervious area?

Impervious surfaces, in comparison to pervious surfaces, greatly increase the volume and velocity of stormwater runoff during storm events, and exacerbate flooding, erosion, and/or pollutant loading to surface waters. Watershed studies associate increases in impervious area with reductions in insect and fish diversity, greater fluctuations in stream hydrographs (flows), reduced base flow, greater stream-bank instability, and increased sediment loading.

Summarizing research concerning the impacts of impervious surfaces upon stream quality, the Center for Watershed Protection developed the “Impervious Cover Model” which classifies the potential stream quality based upon levels of impervious area in a watershed.⁴ With impervious area composing less than 10 percent of the watershed area, streams experience little impact to water quality; between 11-25 percent streams are potentially “impacted” and experience stream channel widening, bank erosion, or loss of sensitive aquatic life; at levels greater than 25 percent the stream potentially becomes “non-supporting” for pollutant-sensitive aquatic life and for swimming.

However, factors besides impervious cover can significantly influence water quality impacts, such as the types of impervious land uses in the watershed, the nature of the adjacent pervious land uses (e.g.; lawn, forest, cornfield, barnyard), the locations of the developed areas within the watershed, the types of stormwater management systems in place and the condition of the riparian areas adjacent to streams. Data from New Hampshire support both the impervious area-water quality relationship and the importance of riparian buffers. In a study of ten small (avg. 2.8 sq. mi.) watersheds in the seacoast region, USGS and the N.H. Coastal Program found a significant correlation between most water quality parameters and most measures of urbanization.⁵

² AOT rule would include any surface with a runoff Curve Number (CN) \geq 98.

³ Impervious surfaces listed in the Act’s definition under RSA 483:B-3, VII-a will be considered impervious by the Shoreland Protection Program unless otherwise designed to effectively absorb water.

⁴ The Stormwater Center website under “Monitor/Assess”, Impervious Cover Model (<http://www.stormwatercenter.net/>)

⁵ Deacon, JR, SA Soule, and TE Smith, Effects of urbanization on stream quality at selected sites in the Seacoast region in New Hampshire, 2001-03: U.S. Geological Survey Scientific Investigations Report 2005-5103, 18 p. (2005)

II. DES ADOPTS A MORE INTEGRATED PROTECTION APPROACH

In light of the importance of the factors listed above, focusing solely on the amount of impervious cover in a watershed as a means of protecting water quality is overly simplistic. The AOT and Shoreland Protection rules take a more integrated protection approach (for those projects and in those areas where they apply) by variously maintaining minimal riparian buffers, reducing the volume of stormwater runoff, and limiting or discouraging excessive impervious cover. The rules also include provisions that encourage greater use of pervious areas to infiltrate runoff from adjacent impervious areas, reducing total post-development runoff volume through more widely dispersed infiltration.

III. HOW WILL DES RULES IMPLEMENT THIS APPROACH?

Alteration of Terrain Rules

To implement an integrated approach, the AOT rules encourage the design of stormwater systems that “disconnect” impervious areas, infiltrate runoff through nearby pervious areas, and reduce runoff volume discharged to stormwater collection systems and potentially surface water. Certain stormwater treatment practices (e.g. vegetated buffers) must now be designed with limits to the “flow path”⁶ length and to the amount (percentage) of impervious area draining to the practice. Limiting overland flow path length and impervious area is expected to reduce the total volume of stormwater directed to a practice, resulting in a greater number of disconnected practices, each serving a smaller area.

AOT projects are now required to infiltrate a prescribed amount of stormwater. This amount is based on the area of impervious cover and the type of soil the impervious area is covering up and is referred to as Groundwater Recharge Volume (GRV). The GRV is designed to ensure that the groundwater receives, at a minimum, the pre-development average annual recharge volume of water. Capturing and infiltrating this volume provides necessary groundwater recharge and is expected to minimize the impacts historically associated with increased impervious area, such as stream-bank erosion and surface water quality degradation. Other rule provisions allow for direct infiltration of runoff from a roof (an impervious surface) and provide an exemption from certain setbacks to encourage smaller infiltration practices.

While stormwater practices under AOT rules provide treatment for common pollutants in runoff, the cumulative water quality impact on receiving surface waters is not measured or evaluated. No requirement exists in the AOT rule for the calculation of pollutant loadings or evaluation of a waterbody’s capacity to assimilate certain pollutants. While such a requirement was considered during the rulemaking process, it was not adopted into rule. However, DES can still require pollutant loading analyses and assessments of remaining assimilative capacity to limit water quality degradation (i.e., anti-degradation) under Env-Wq 1700 (Surface Water Quality Standards).

⁶ Flow path length is the path that runoff follows from the origin of overland flow to the point where it enters a concentrated flow area, defined as a channel.

Anti-degradation provisions found in Env-Wq 1700 generally require the following:

- 1) No additional loading of pollutants to the state's Outstanding Resource Waters (ORWs), which are waters within the National Forest boundary and natural segments of rivers designated under the state's Rivers Management and Protection Program;
- 2) No additional loading of pollutants for impaired surface waters that have no EPA approved Total Maximum Daily Load (TMDL) study; or meeting the pollutant loading reductions required for impaired waters with an approved TMDL;
- 3) Projects that propose to increase pollutant loading, where allowed, may be required to conduct an analysis to determine whether there are less polluting alternatives to the development, and may need to provide an economic or social justification for lowering water quality.

DES has convened a working group that is now studying the technical submission requirements necessary to implement the anti-degradation requirements specified under Env-Wq 1700 within the AOT permit process. Over the next year the workgroup plans to review and recommend appropriate models, removal efficiencies for stormwater BMPs, and the method for calculating the removal of pollutants from BMPs designed in series, among other issues. In the interim, most AOT projects are currently presumed to meet the anti-degradation requirements of Env-Wq 1700 if stormwater BMPs are designed, built and maintained in accordance with AOT requirements. Exceptions include projects that discharge to impaired waters with an approved TMDL or require an individual 401 Water Quality Certification (DES certifies that construction and operation of the project will not violate water quality standards). For these projects, quantitative analyses are required to demonstrate compliance with pollutant reductions specified in an EPA approved TMDL or anti-degradation provisions.⁷

Once the workgroup has completed its charge and anti-degradation provisions are incorporated into the AOT regulations, DES expects all AOT projects will be required to provide some type of quantitative analysis demonstrating compliance with anti-degradation (e.g. the project maintains the same or reduces pollutant loads to impaired waters). The application of anti-degradation provisions to AOT projects is an important step to minimizing cumulative water quality impacts to New Hampshire's surface water, and further protecting those used for water supply.

Shoreland Protection Rules

Under the Comprehensive Shoreland Protection Act (CSPA) as amended in 2008, most impervious surfaces are prohibited within a "Waterfront Buffer" (50 feet from the shoreline) adjacent to certain public waters.⁸ The CSPA applies to fourth- and higher-order streams (approximately 14% of all streams), great ponds, designated rivers or river segments (even less than 4th order) under the Rivers Management and Protection Program, and artificial

⁷ Most applicants that fall in these categories use interim guidance and a spreadsheet model created by DES to perform their loading analyses.

⁸ Under the Act, the upper limit on the amount of impervious surface is 30%. If development increases the impervious area to greater than 20% of the total lot area within the protected shoreland (within 250 ft of the reference line), a stormwater management system must be implemented and maintained as well as planting native trees, shrubbery or groundcover within segments of the waterfront buffer to meet the minimum tree and sampling score under RSA 483-B:9.

impoundments that are 10 acres or larger. Impervious surface area is limited to 30% of the total lot area within the protected shoreland area (e.g. 250 feet from the reference line of the protected public waters).

Applications for Shoreland Protection permits include development plans which are required to identify impervious and “altered” (e.g. disturbed) areas in order to demonstrate compliance with the rule’s new requirement for some land to remain in an unaltered state.⁹ The CSPA defines “unaltered state” as native vegetation allowed to grow without cutting, limbing, trimming, pruning, mowing, or other similar activities except as needed to maintain the health of the plant being trimmed, as allowed by rules of the department.” This definition is broad, however, and requires DES to determine what constitutes alteration. For example, it is not clear whether seeding an area designated to be “unaltered” with Kentucky blue grass, which is less pervious than most native grasses, and requires more water and fertilizer, would be considered alteration under the Shoreland Protection Program’s rules.

IV. Not All Pervious Surfaces Are the Same

Many activities and uses may degrade pervious surfaces in designated undisturbed (e.g. unaltered) areas and this may have significant impact to water quality.

This gray area may be a cause for concern because “While there is no doubt that impervious surfaces are the primary contributors of our urban and suburban runoff, the traditional landscape surrounding our impervious surfaces can be a poor substitute for the benefits, hydrologic and otherwise of native landscapes.”¹⁰

Rules that restrict the disturbance of natural areas are designed to maintain natural landscape features (vegetation, soils) to mitigate runoff impacts (through filtration by vegetation and litter and infiltration through soil and subsoil). However, if soils are compacted or vegetation is altered or reduced through human or animal activities, greater impacts can be expected. Removing natural vegetative cover and replacing it with lawns or other landscaped areas can greatly reduce its capacity to infiltrate runoff. Recreational activities, such as camping, hiking, or ATV use, common along many of the state’s rivers and lakes, can also compact soils and damage vegetation.

Compaction can radically change pore structure and infiltration capacity. In 2002 researchers from the University of Alabama found that infiltration rates for non-compacted sand were more than two times higher than those for compacted sands, from one-and-a-half to four times higher for non-compacted clays than for compacted clays, and up to 30 times higher for non-compacted silty loamy soils than for compacted silty loamy soils.¹¹

Soil compaction or removal of vegetation can concentrate (channelize) runoff flow and reduce the effectiveness of riparian buffers. As illustrated in guidance from the University of New Hampshire’s Cooperative Extension, it is critical to maintain shallow sheet flow *into* and across

⁹ Under the Act, lots with less than or equal to ½ acre within the Natural Woodland Buffer (NWB), defined as 50 – 150 ft from the reference line, must maintain 25 percent of the of the area in the NWB in an unaltered state. Lots with greater than ½ acre in the NWB must maintain 50 percent of the area within the NWB, exclusive of allowed impervious surface area, in an unaltered state.

¹⁰ Booth, Derek, B. et al., Forest Cover, Impervious-Surface Area, and the Mitigation of Stormwater Impacts; Journal of the American Water Resources Association, v. 38:835-845 (2002)

¹¹ Ibid. pg 9

the buffer. Where concentrated flow paths begin to form or deep sediments begin to accumulate, the buffer can no longer maintain its filtering ability.¹²

V. WHAT ARE THE OPPORTUNITIES TO IMPROVE PROTECTION?

The AOT and Shoreland Protection rules include significant changes that improve protection of the state's surface waters. Amendments to the CSPA and to the AOT rule have required significant effort to resolve differences and balance the interests of many stakeholders involved in the legislative and/or rulemaking process. Given the diversity of viewpoints and stakeholders, and the compromises made to produce these rules, it is likely that any major policy or rule amendments (e.g. expanding shoreland buffers, expanding applicability of the CSPA to lower-order rivers, or reducing impervious cover limits) would meet with significant resistance. However, opportunities exist to better address the management of pervious areas, which may provide significant benefits for water quality, since both the AOT and Shoreland Protection rules are expected to be open to amendment again in the coming year. Each of the following changes could be pursued without amending the enabling legislation, although they could potentially be seen as substantially increasing the reach or the restrictiveness of the rules:

- **Adopt Anti-degradation Provisions.** (AOT program only) Anti-degradation provisions were included in draft versions of the AOT rule during the rulemaking process but were not adopted into the final version of the rule as there was insufficient time to explain the provisions to the regulated community and reach consensus concerning how to demonstrate compliance with the anti-degradation requirements. Adoption of such provisions within AOT rules could provide quantitative analysis to better estimate the capacity of surface water to assimilate pollutants and maintain or improve surface water quality. DES' Watershed Management Bureau is promoting an approach that includes requiring a pollutant loading analysis for impaired waters and outstanding resource waters to demonstrate that a proposed activity will not increase pollutant loading. Under this approach, exceeding certain thresholds for Effective Impervious Cover¹³ (EIC > 10 percent of the project area) or Undisturbed Cover¹⁴ (UDC < 65 percent) would require project designers to demonstrate no additional pollutant loading to impaired waterbodies or ORWs or to calculate the percentage of the remaining assimilative capacity of the water body. Avoiding the requirement to perform such an analysis would become an incentive for project designs to meet the EIC/UDC thresholds, resulting in less runoff being discharged into stormwater collection systems, larger naturally pervious areas (e.g. UDC) and greater dispersion and disconnection of runoff from impervious areas.
- **Refine Rule Definitions Related to “Undisturbed/Unaltered” Areas.** Both the AOT and Shoreland rules could clarify the types of activities or uses that may be allowed (if any) within these undisturbed/unaltered areas, establish conditions of use and maintenance, and establish criteria that the programs can use to measure or evaluate disturbance and potential for water quality impacts.

¹² Klapproth, Julia C., Johnson, James E., Understanding the Science Behind Riparian Forest Buffers: Effects on Water Quality, Virginia Cooperative Extension, (2000).

¹³ Effective impervious cover (EIC) is the cover from which stormwater is generated and discharged into a stormwater collection system; it excludes runoff generated from impervious surfaces infiltrated into nearby pervious surfaces. A maximum EIC value was considered but not adopted into the final AOT rule.

¹⁴ “Undisturbed cover” (UDC) means a natural land surface whose permeability has not been altered by human activity. A maximum UDC value was considered but not adopted into the final AOT rule.

- **Develop Incentives to “Disconnect” Runoff.** (Shoreland Protection Program only) The CSPA gives authority to DES to require and approve stormwater management plans when impervious cover will exceed 20 percent of the area of a lot within the protected shoreland. Neither the statute nor the rule includes an explicit requirement for disconnection of runoff from impervious areas to the storm drain network and receiving waters. DES could develop incentives for designers to submit designs that maximize infiltration and minimize runoff through disconnection of stormwater from impervious areas.
- **Ensure Permanent Protection/Maintenance of Undisturbed Areas.** DES programs could consider legal instruments (e.g. conservation easements, deed restrictions) as a means to control alteration of vegetative cover and/or to maintain undisturbed areas in order to preserve the long-term capacity of these areas to remain pervious and infiltrate and filter stormwater.
- **Develop an integrated approach to managing stormwater, impervious area, and riparian buffers to be incorporated into Water Supply Watershed Management Plans.** DES permit programs primarily evaluate impacts at the parcel level. Many development projects fall below the size threshold that triggers the applicability of the AOT rules, and 86% of streams and rivers are not covered by the CSPA. To adequately address the goal of maintaining water quality in water supply watersheds, watershed-scale management plans could be developed that address the broad range of activities that can affect water quality. In consultation with DES’ Watershed Management Bureau, Drinking Water Source Protection Program resources (grants, technical assistance) could be used to support the development of such plans where there is sufficient local interest. Currently 17 of 57 surface water supply sources have watershed plans. (No rule change needed.)